MONTANA WATER QUALITY

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Ecosystems Management Section
Water Quality Bureau
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Helena, MT 59620

THE MONTANA 305(b) Report

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1.0 SUMMARY.

The federal Clean Water Act (Public Law 92-500), section 305(b) and section 106(e)(1), requires each state to submit a biennial report on surface and ground water quality. The following is the 1992 §305(b) report for the State of Montana.

The guidelines for the preparation of the 1992 state water quality assessments were supplied by the US EPA. The report format and summary information presented here follow those guidelines. The Montana Waterbody System used for previous reports has been replaced by a similar software system recommended and supplied by the US EPA for this reporting period.

The Montana water quality assessment report (§305(b)) has been and continues to be an invaluable tool for making management decisions and monitoring the water resources of the State. The report is also used by the US EPA in its preparation of a national water quality report to the Congress of the United States.

Waterbody size estimates have been revised upward by the US EPA. The new data places Montana number three in the Nation for perennial stream miles and total stream miles, and number six for number of lakes, acres of lakes larger than 500 acres and total lake acreage.

The waterbody size monitored during the reporting period has also increased by over 2500 miles of streams and 54,000 acres of lakes.

The use classifications of Montana's waterbodies have remained unchanged during the reporting period. Only three waterbody segments are classified as I.

Ninety percent of Montana's stream miles and more than two thirds of its lake acres support the overall use category.

The majority of stream and lake impairment is from nonpoint sources. Agricultural practices are the leading sources of nonpoint source pollution.

Successful long term trend analysis has been limited to the Clark Fork River Basin and Flathead Lake. The Clark Fork River has shown improvement over the last several years. Copper concentrations in the headwater reaches have decreased and phosphorus concentrations have decreased in the lower reaches. Unfortunately Flathead Lake has decreased in it's quality as evidenced by increased algal growth.

Although progress in wetland assessment has been slow, a statewide wetlands program is just now beginning. The information gathered will address many of the concerns about wetland conditions and size. The educational projects being started will foster understanding and appreciation for wetlands and may prove to be the key in stabilizing wetland loss. The development of wetland water quality and biological standards will establish the necessary monitoring and enforcement parameters.

Studies under the Clean Lakes Program are being implemented which will develop the nutrient balance and primary productivity status of Flathead Lake and Swan Lake. A third study will investigate methylmercury and PCBs in fish tissue and sediments and the trophic status of the twenty most heavily fished lakes in Montana.

Natural contamination of much of the state's water by arsenic remains a concern.

The nonpoint sources of pollution in domestic surface water supply watersheds are receiving increasing scrutiny. Watershed management policies are impacting the ability of water supplies to avoid filtration requirements in light of strict turbidity and coliform bacteria concentration standards.

Ground water resources of the State for the most part have not been degraded. However, like surface waters, localized areas of contaminated ground water exist and natural quality varies widely across the State.

Ninety-six percent of the public water supplies in Montana rely on ground water. A wellhead protection program plan to protect these public water supplies has been submitted for EPA approval. The sources of ground water contamination are being identified and preventive, control and remedial actions are being taken.

The demands placed upon Montana's natural resources and the impact of those developments on its water resources are straining present staff and financial capabilities. To protect the remaining high quality waters and improve the quality of presently impaired waters, increased funding from federal and state sources is needed. If the present voluntary nonpoint source control programs prove to be ineffective in reducing pollution, a regulatory program will need to be established.

2.0 BACKGROUND.

2.1 Atlas.

Montana is the fourth largest state of the Union and continues to be sparsely settled with fewer than six people per square mile (Table 1). The major industrial-economic base of the state consists of recreation-tourism, agriculture, forest products and resource extraction. Montana has experienced relatively little urban development, manufacturing and heavy industry. Hydropower and coal-fired generation facilities are the dominant sources of electrical power. Montana is an exporter of electrical power.

Table 1. Montana atlas.

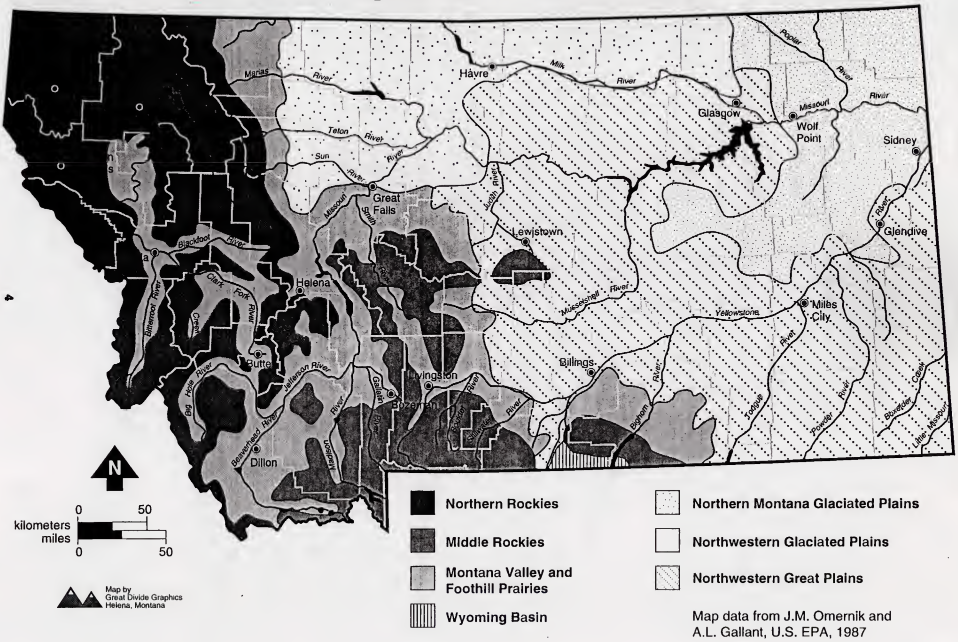
Parameter	Size
State population	799,065 people[1]
State surface area	145,556 square miles
Number of major river basins	16 river basins
Total number of stream miles	178,896 miles[2]
Number of border stream miles	0 miles
Number of lakes/reservoirs/ponds	10,499 lakes[2]
Acres of lakes/reservoirs/ponds	979,433 acres[2]
Acres of freshwater wetlands	1,863,116 acres[3]

1 1990 census
2 Total stream miles and lake acres in the EPA Reach File (version 3.0)
3 Estimated as 2% of the state's total surface area; includes stream riparian areas

Montana contains the headwaters for three continental watersheds (Clark Fork-Pend Oreille-Columbia, Yellowstone-Missouri-Mississippi and St. Mary-Saskatchewan-Nelson), which have been further divided into 16 major basins for management purposes.

Montana has a uniquely varied geography and climate. Seven major ecoregions are represented in the state (Figure 1). The ecoregions are the Middle Rockies, Montana Valley and Foothill Prairies, Northern Rockies, Northern Montana Glaciated Plains, Northwestern Great Plains, Northwestern Glaciated Plains and the Wyoming Basin. Natural water quality associated with each ecoregion varies considerably, from sensitive, very low dissolved solids water

Figure 1. Ecoregions of Montana



of the alpine and inter-mountain regions to very high dissolved solids water of some semi-arid environments.

2.2 Summary of Classified Uses.

The use classification system of Montana waters has remained unchanged during the 1990-92 reporting period (Table 2). Three stream segments have been classified as C-1 or C-2 (lower Rainy Creek, the upper Clark Fork River, and lower Ashley Creek,). Three stream segments are designated as "I" class stream segments (Prickly Pear Creek below East Helena, Silver Bow Creek and Muddy Creek). The goal of the State of Montana is to improve the water quality of the "I" classification waterbody segments so as to fully support their designated uses.

The remainder of waterbodies in Montana are A (A-closed and A-1), B (B-1, B-2 and B-3) or C-3. Waterbodies classified as A are primarily intended for domestic uses with minimal treatment prior to use. The B classification waterbodies are suitable for domestic use and the growth and propagation, or marginal propagation, of salmonid fishes (non-salmonid fish for the B-3 classification). The C classifications are suitable for recreational use and the growth and propagation, or marginal propagation, of salmonid fishes (non-salmonid fish for the C-3 classification). The water quality standards for toxic, non-conventional (e.g., ammonia) and conventional (e.g., total suspended solids) pollutants are part of each use classification. Water quality criteria specifically for lake waters or wetlands have not been developed at this time. The water quality standards described apply to all surface waters unless specifically noted.

Table 2. Water-use classifications summary for Montana. Source: Montana Surface Water Quality Standards, Administrative Rules of Montana, Title 16, Chapter 20.

A-CLOSED CLASSIFICATION: Waters Classified A-Closed are suitable for drinking, culinary and food processing purposes after simple disinfection.

A-1 CLASSIFICATION: Waters classified A-1 are suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities.

B-1 CLASSIFICATION: Waters classified B-1 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

B-2 CLASSIFICATION: Waters classified B-2 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

B-3 CLASSIFICATION: Waters classified B-3 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

C-1 CLASSIFICATION: Waters classified C-1 are suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

C-2 CLASSIFICATION: Waters classified C-2 are suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

C-3 CLASSIFICATION: Waters classified C-3 are suitable for bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers. The quality of these waters is naturally marginal for drinking, culinary and food processing purposes, agriculture and industrial water supply.

I CLASSIFICATION: The goal of the state of Montana is to have these waters fully support the following uses: drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

3.0 METHODS.

3.1 Waterbody Assessments.

A variety of information sources have been used in developing waterbody assessments. Sources include Montana Fish, Wildlife and Parks lake and stream data, US Forest Service data, STORET (a national water quality database) retrievals, Montana Water Quality Bureau field assessments and surveys and other information as available. Fixed station, long-term monitoring networks supported by the State of Montana Water Quality Bureau have emphasized the Clark Fork River Basin and Flathead Lake.

The in-house waterbody tracking system used for the previous §305(b) cycles has been replaced by a similar waterbody tracking system (WBS version 3) recommended by the US EPA for the 1992 cycle. Transfer and conversion of the previous database to the new software format was performed by US EPA contractors at the Research Triangle Institute (RTI). Summary tables presented in this report were generated using the WBS reporting features and database.

Where possible the "detailed" method of waterbody assessment has been used. Under the detailed approach of waterbody assessment each assessed stream, lake or reach of a stream was assigned a general basin code and a specific segment number. The waterbody identification number allows for a logical and detailed cataloging of Montana's waterbodies.

The Montana use classification system described above incorporates multiple uses for all classifications. Waterbodies which have no significant or known use impairments associated with them are defined to be fully supporting. When one or more uses are slightly or moderately impaired but most other uses are not affected, the waterbody was identified as partially supporting. Waterbodies where one or more of its designated uses were severely impaired, even though most other uses were supported, was identified as not supporting.

Exceeding a water quality standard (either numeric or descriptive) constitutes use impairment to some degree. The magnitude, frequency and persistence of the exceedance are evaluated in the use support assessment

process. Evaluation of a waterbody use support status has been consistent with that described in the Guidelines for the Preparation of the 1992 State Water Quality Assessments (305(b) Reports)[1].

3.2 Waterbody Size.

The water resources of Montana are as diverse as its geography. A waterbody may be a natural lake or stream, or a manmade reservoir or ditch. Streams may be perennial or intermittent (i.e., flowing seasonally or beneath the streambed for portions of its length).

The size estimate of Montana's water resources has been revised upward by the US EPA.[2] The computerized waterbody map Reach File Version 3 (RF3) is based upon the US Geological Survey (USGS) Digital Line Graph (DLG) database and will replace earlier estimates of River Reach File 2 (RF2). The new mileage estimates place Montana third in the Nation for perennial stream miles (51,987 mi.) and total stream miles (178,896 mi.). Although the DLG database indicates nearly 3.5 times more total miles than previous estimates, the total perennial stream size was within one percent of the previous stream miles estimate (51,212 mi.). The new total mileage includes 6,838 miles of ditches and 120,071 miles of intermittent streams which were not included in earlier estimates.

The estimate of Montana's lake acreage has likewise been revised upward. Montana ranks sixth in the Nation for number of lakes (10,499), acreage of lakes greater than 500 acres (805,891 ac.) and total lake acreage (979,433 ac.). The Montana Department of Fish, Wildlife and Parks (DFWP) Lake Fishery Database used for previous reporting periods identified 1,978 lakes totaling 666,077 acres. Lakes not included in the DFWP database were primarily small high-elevation lakes, small reservoirs, stock ponds and wetland potholes, which apparently the RF3 lake database has included. A separate acreage estimate for manmade waterbodies is not available.

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[1]Guidelines for the Preparation of the 1992 State Water Quality Assessments (305(b) Reports), U.S. Environmental Protection Agency, Office of Water, Washington, D.C., August 1991.

[2]Total State Waters: Estimating River Miles and Lake Acreages for the 1992 Water Quality Assessments (305(b) Reports), Draft, U.S. Environmental Protection Agency, Office of Water, Washington, D.C., December 1991.

3.3 Assessment Types.

All waterbodies in Montana have been identified to be fully supporting their designated uses unless assessed otherwise by evaluated or monitored assessment procedures.

Evaluated assessments are made using chemical, physical or biological data and other information which may not be as up-to-date or as extensive as needed for monitored assessments. Best professional judgement (BPJ) may also be a relatively large component of the evaluated assessment. The majority of streams in Montana have had their use support designation made using evaluated assessment procedures (Table 3).

Monitored assessments are made using biological data, water chemistry data and stream habitat assessments that are less than five years old. These up-to-date and more extensive data sets are best used to monitor trends in priority waterbodies.

Table 3. Overall level of use support of streams using evaluated and monitored assessment methods.

Number of Evaluated Streams: 583
Number of Monitored Streams: 223

Degree of Use Support	Assessment Type		
	Miles Evaluated	Miles Monitored	Total Miles
Fully Supporting	160,951	804	161,755
Threatened	2,620	615	3,235
Partially Supporting	9,144	3,397	12,541
Not Supporting	1,004	361	1,365
Not Attainable	0	0	0
Total	173,719	5,177	178,896

4.0 STREAMS.

4.1 Use Support.

The monitored stream size for all categories of use support (Table 3) increased by 2,527 miles during the 1990-92 reporting cycle. The fully supporting but threatened category for monitored streams increased nearly eight times (80 to 615 miles) and the combined monitored and evaluated stream mileage in the threatened category increased by 41 miles over the mileages reported in 1990.

The total length of streams that were partially supporting or not supporting their designated uses increased 597 mi. and 99 mi., respectively. A portion of the increases may be attributed to new field assessments and re-evaluation of previous use-support decisions.

The evaluated fully supporting category for streams has been adjusted to reflect the increased total waterbody size identified by RF3.

Table 4 lists stream miles assessed for each level of support and corresponding designated uses, including the federal Clean Water Act fishable and swimmable goals. The aquatic life support category includes fishery use and associated aquatic life. By far the majority of streams in Montana meet the swimmable and fishable goals of the federal Clean Water Act. In the best professional judgement of the Montana Water Quality Bureau staff, those segments which did not support the fishable-swimmable goals during the 1992 reporting cycle are capable of attaining these uses.

Table 4. Level of support for individual uses of Montana streams (miles).

Use	Supporting	Supporting but Threatened	Partially Supporting	Not Supporting	Not Attainable	Not Assessed
Overall Use Support	162,492	3,194	11,944	1,266	0	0
Aquatic Life Support	42,350	3,121	36,058	3,377	0	0
Swimming and Recreation	68,251	504	14,272	1,773	0	0
Drinking Water Supply	8,770	1,313	6,261	742	0	0
Nondegradation	0	25	19	0	0	0
Agriculture	11,598	351	4,729	448	0	0
Industrial Use	16,575	356	40	154	0	0

Care must be exercised when reading these and subsequent tables. The designated uses, impairment causes and impairment sources listed are not mutually exclusive. Causes of pollution include the pollutant categories (e.g., nutrients) and pollution processes (e.g., habitat destruction) which result in the nonattainment of water quality standards. Sources of pollution generate the pollutants (e.g., irrigated crop production). Any particular waterbody may be classified for more than one designated use or may be impacted by more than one source or cause. For example, a waterbody may partially support aquatic life and yet fully support agriculture and industrial uses.

The impairment cause and source category sizes listed are not additive. Adding the sizes under a general heading will not result in a valid grand total because of multiple use and support designations.

Ninety percent of the total stream miles of Montana fully support all of their designated uses. The majority of stream miles not fully supporting their designated uses are impacted by nonpoint source categories. Agricultural sources of nonsupport (crop production and range land) dominate the mileage impacted (Table 5). Flow alteration, suspended solids and siltation rank at or very near the top of non-support cause categories for streams (Table 6).

Table 5. Sources of impairment for Montana streams (miles).

SOURCE CATEGORIES	Impact: Major	Impact: Moderate/Minor	Total
POINT SOURCES:			
Industrial Point Sources	0	339	339
Municipal Point Sources	46	1,373	1,419
Other Dischargers	0	14	14
NONPOINT SOURCES:			
Agriculture (General)	52	1,100	1,152
Nonirrigated Crop Production	63	1,976	2,039
Irrigated Crop Production	406	7,345	7,751
Pasture Land	51	839	890
Range Land	74	5,913	5,987
Feedlots - All Types	0	89	89
Aquaculture	0	9	9
Animal Holding/Management Areas	8	166	174
Silviculture (General)	2	1,387	1,389
Harvesting, Restoration, Residue Management	0	238	238
Road Construction/Maintenance	0	292	292
Construction (General)	0	35	35
Highway/Road/Bridge	5	1,218	1,223
Land Development	0	312	312
Urban Runoff/Storm Sewers (General)	0	83	83
Storm Sewers	0	38	38
Surface Runoff	0	23	23
Resource Extraction (General)	3	671	674
Surface Mining	3	133	136
Subsurface Mining	244	310	554
Placer Mining	64	259	323
Dredge Mining	28	172	200
Petroleum Activities	15	452	467
Mill Tailings	75	256	331
Mine tailings	54	250	304
Land Disposal (General)	0	57	57
Wastewater	0	32	32
Landfills	0	13	13
Industrial Land Treatment	3	0	3
Onsite Wastewater Systems (Septic Tanks)	0	118	118
Septage Disposal	0	15	15
Hydromodification (General)	0	35	35
Channelization	25	674	699
Dredging	0	32	32
Dam Construction	19	500	519
Flow Regulation/Modification	145	1,707	1,852
Bridge Construction	0	6	6
Removal of Riparian Vegetation	0	520	520
Streambank Modification/Destabilization	94	3,925	4,019
OTHER:			
Atmospheric Deposition	7	0	7
Highway Maintenance and Runoff	0	242	242
Natural	427	7,701	8,128
Upstream Impoundment	24	348	372

Table 6. Stream miles not fully supporting uses as affected by various cause categories.

Cause Categories	Impact Major	Moderate/Minor	Total
Priority Organics	0	52	52
Nonpriority Organics	0	39	39
Metals	565	3,979	4,544
Unionized Ammonia	46	331	377
Other Inorganics	300	4,239	4,539
Nutrients	104	5,628	5,732
Ph	39	689	728
Siltation	303	6,497	6,800
Organic Enrichment/Dissolved Oxygen	47	932	979
Salinity/Total Dissolved Solids /Chlorides	431	5,449	5,880
Thermal Modifications	138	2,534	2,672
Flow Alteration	552	6,686	7,238
Other Habitat Alterations	314	5,264	5,578
Pathogens	8	1,600	1,608
Radiation	0	5	5
Taste and Odor	0	141	141
Suspended Solids	338	6,747	7,085
Noxious Aquatic Plants	0	158	158

4.2 Water Quality Trends.

Accurate trend analysis of a natural system impacted by diverse human processes is difficult at best. Long term trend analysis at several locations on the Yellowstone and Missouri rivers has been attempted with indefinite results. Relatively wide year-to-year fluctuations in the mean annual concentration of nutrients and other variables made trend line interpretation inconclusive. Climatic variability and changes in analytical methods has possibly overshadowed any real trend that may be present.

An exception has been the Clark Fork River. Historic mining and smelting activities in the headwaters areas have been sources of copper to the river. Copper concentration data (Montana total recoverable) collected by the Water Quality Bureau have shown a downward trend in the headwater segments. The slow process of mine tailings removal and stabilization may be reducing the copper concentrations in the river. Further improvements are expected as Superfund related activities in the basin progress. Total phosphorus and soluble phosphorus have shown similar downward trends in the middle segments of the river. Phosphorus detergent bans and improved industrial waste treatment appear

to be reducing the phosphorus loading to the middle Clark Fork River.

4.3 Water Quality-Limited Waterbodies In Need Of Total Maximum Daily Loads (TMDLs).

The federal Clean Water Act section 303(d) requires that water quality-limited waterbodies have Total Maximum Daily Loads (TMDLs) determined for variables out of compliance with water quality standards. The TMDL process uses water quality standards as the basis for developing a rational method of pollution reduction. Pollution control methods identified by the TMDL process may be more stringent than the technology-based controls in place (e.g., nutrient removal in addition to secondary treatment of municipal wastewater).

The TMDL process considers point sources, nonpoint sources, natural sources and a margin of safety in the allocation of loads to meet water quality standards. In Montana the TMDL process will most often use the phased development approach as described in the EPA TMDL guidance[3]. An outline of the approach follows:

1) Identify the water quality limited waters in need of TMDL development.
2) Prioritize the list of waters.
3) For each waterbody listed, according to its priority,
   a. Determine the load contribution of each source category;
   b. Implement nonpoint source best management practices (BMPs) and state-of-the-art point-source controls as necessary;
   c. Monitor and assess control effectiveness and models used; and
   d. Schedule full implementation of controls.
4) Submit the TMDL plan to the US EPA for approval.
5) Implement the plan controls and monitor water quality criteria.
6) If the water quality standards are met the waterbody will be removed from the §303(d) list. If the water quality standards are not met the control methods and models used are re-evaluated and new control methods implemented.

The TMDL process allows for public comment and local community involvement in decision making.

The State of Montana §303(d) list of waters in need of TMDL development, and a priority ranking of those waters, will be developed as a parallel document to this report. The document will be made available upon request.

4.4 Toxics.

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[3]Guidance for Water Quality-based Decisions: The TMDL Process, U.S. Environmental Protection Agency, Office of Water, Washington, D.C., April 1991.

The total waterbody size affected by toxics is presented in Table 7. The stream miles with elevated levels of toxics may be divided into two general categories: man-caused and natural. The principal man-caused toxics are heavy metals and arsenic associated with past metals and coal mining.

Table 7. Assessed waterbody size affected by toxics.

Waterbody Type / Units		Total Size Assessed For Toxics	Size with Elevated Levels of Toxics
Streams	(miles)	43,674	4,502
Lakes	(acres)	615,935	270,847

Natural sources of arsenic are responsible for most of the waterbodies impacted by toxics in Montana. Geothermal sources associated with the Greater Yellowstone Ecosystem have impacted the Madison River (103 mi.), Yellowstone River (574 mi.) and Missouri River (572 mi.). Geologic materials in the watersheds of the Milk River (350 mi.), Powder River (200 mi.) and Tongue River (173 mi.) have contributed arsenic to the associated waterbodies.

The maximum acceptable increased risk of cancer caused by exposure to arsenic has been identified as one case per one million people for Montana waters. Unlike many carcinogen risk estimates, studies of human population response to ingesting a wide range of drinking water arsenic concentrations[4,5] were used as a basis for the adopted Montana human health standard of 0.002 μg/L total recoverable arsenic. The US EPA drinking water standard is 50 μg/L arsenic[6].

The present detection limit for the atomic absorption, spectrophotometric,

[4] Tseng, W.P., 1977, Effects and dose-response relationships of skin cancer and Blackfoot disease with arsenic. Environ. Health Perspect. 19:109-119.

[5] Tseng, W.P., H.M. Chu, S.W.How, J.M. Fong, C.S. Lin, S. Len, 1968, Prevalence of skin cancer in an endemic area of chronic arsenicism in Taiwan. J. Natl. Cancer Inst. 40(3):453-463.

[6] U.S. Environmental Protection Agency, 1986, National primary drinking water regulations, 40 C.F.R. Part 141, July 1, 1986 edition.

gaseous hydride method of arsenic analysis is 1 $\mu g/L$. Therefore, the human health standard for arsenic is exceeded and its drinking water use is impaired when arsenic has been detected in a waterbody.

Persistent drought conditions which have plagued Montana may have aggravated the arsenic problems. Precipitation has been too low to maintain flows in uncontaminated tributaries which may have been capable of diluting the arsenic. And agricultural irrigation usage is further diminishing the already low in-stream flows and concentrating arsenic through evapotranspiration losses.

Arsenic and heavy metals on the priority pollutant list associated with metals mining and processing operations have been the most commonly analyzed toxics. Water samples are analyzed for organic pollutants when those chemicals are suspected to be present. The water quality criteria for priority pollutants for the State of Montana are presented in Table 8.

Table 8. List of priority pollutants and criteria during the 1990-1992 reporting cycle.

Water Quality Criteria[1]
Priority Pollutants

Pollutant	Aquatic Life Class A,B1-3,C1-3,I[8] Acute	Aquatic Life Class A,B1-3,C1-3,I[8] Chronic	Human Health Value Class A,B1-3,I[2][8]	Human Health Value Class C1-3,I[3][8]
Acrolein			320	780
Acrylonitrile[4]			0.058	0.65
Benzene[4]			0.66	40
Benzidine[4]			0.00012	0.00053
Carbon tetrachloride[4] (Tetrachloromethane)			0.40	6.94
Chlorobenzene (Monochlorobenzene)			488	
Hexachlorobenzene[4]			0.00072	0.00074
1,2-Dichloroethane[4]			0.94	243
1,1,1-Trichloroethane			200	1,030,000
Hexachloroethane[4]			1.9	8.74
1,1,2-Trichloroethane[4]			0.60	41.8
1,1,2,2-Tetrachloroethane[4]		0.17	10.7	
Bis(2-chloroethyl) ether[4]		0.03	1.36	
2,4,6-Trichlorophenol[4]			1.2	3.6
Chloroform (HM)[4] (Trichloromethane)			0.19	15.7
1,2-Dichlorobenzene			400	2,600
1,3-Dichlorobenzene			400	2,600
1,4-Dichlorobenzene			75	2,600
3,3'-Dichlorobenzidine[4]			0.01	0.02
1,1-Dichloroethylene[4]			0.033	1.85
2,4-Dichlorophenol			3,090	
1,3-Dichloropropylene (1,3-Dichloropropene) (cis and trans isomers)			87	14,100
2,4-Dinitrotoluene[4]			0.11	9.1
1,2-Diphenylhydrazine[4]			0.042	0.56
Ethylbenzene			1,400	
3260Fluoranthene			42	54
Bis(2-chloroisopropyl) ether			34.7	4,360
Methylene chloride (HM)[4] (Dichloromethane)		0.19	15.7	
Methyl chloride (HM)[4] (Chloromethane)			0.19	15.7
Methyl bromide (HM) (Bromomethane)			0.19	15.7
Bromoform (HM)[5] (Tribromomethane)			0.19	15.7
Dichlorobromomethane (HM)[5]		0.19	15.7	
Chlorodibromomethane(HM)[5]		0.19	15.7	
Hexachlorobutadiene[4]			0.45	50

Table 8. Continued.

Pollutant	Aquatic Life Class A,B1-3,C1-3,I[8] Acute	Aquatic Life Class A,B1-3,C1-3,I[8] Chronic	Human Health Value Class A,B1-3,I[2][8]	Human Health Value Class C1-3,I[3][8]
Hexachlorocyclopentadiene		206		
Isophorone[4]			5,200	52,000
Nitrobenzene			19,800	
2,4-Dinitropnenol			70	14,300
4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)			13.4	765
N-Nitrosodimethylamine[4]			0.0014	16
N-Nitrosodiphenylamine[4]			4.9	16.1
Pentachlorophenol	20[7]	13[7]	1,010	
Phenol			3,500	
Bis(2-ethylhexyl)phthalate[4]		15000	50,000	
Di-n-butyl phthlate			35,000	154,000
Diethyl phthalate			350,000	1,800,000
Dimetyl phthlate			313,000	2,900,000
Benzo(a)anthracene (PAH)[4] (1,2-Benzanthracene)		0.0028	0.0311	
Benzo(a)pyrene (PAH)[4] (3,4-Benzopyrene)			0.0028	0.0311
Benzo(b)fluoranthene (PAH)[4] (3,4-Benzofluoranthene)		0.0028	0.0311	
Benzo(k)fluoranthene(PAH)[4] (11,12-Benzofluoranthene)		0.0028	0.0311	
Chrysene (PAH)[4]			0.0028	0.0311
Acenaphthylene (PAH)[5]			0.0028	0.0311
Anthracene (PAH)[5]			0.0028	0.0311
Benzo(g,h,i)perylene (PAH)[5] (1,12-Benzoperylene)		0.0028	0.0311	
Fluorene (PAH)[5]			0.0028	0.0311
Phenanthrene (PAH)[5]			0.0028	0.0311
Dibenzo(a,h)anthracene (PAH)(c) (1,2,5,6-Dibenzanthracene)			0.0028	0.0311
Indeno(1,2,3-cd)pyrene (PAH)(c)			0.0028	0.0311
Pyrene (PAH)[5]			0.0028	0.0311
Tetrachloroethylene[4]			0.8	8.85
Toluene			14,300	424,000
Trichloroethylene[4]			2.7	80.7
Vinyl chloride[4] (Cloroethylene)			2.0	525
Aldrin[4]	3.0		0.000074	0.000079
Dieldrin[4]	2.5	0.0019	0.000071	0.000076
Chlordane[4]	2.4	0.0043	0.00046	0.00048
4,4'-DDT[4]	1.1	0.001	0.000024	0.000024
4,4'-DDE[4]			0.000024	0.000024
4,4'-DDD[4]			0.000024	0.000024

Table 8. Continued.

Pollutant	Aquatic Life Class A,B1-3,C1-3,I(8) Acute	Aquatic Life Class A,B1-3,C1-3,I(8) Chronic	Human Health Value Class A,B1-3,I(2)(8)	Human Health Value Class C1-3,I(3)(8)
alpha-Endosulfan	0.22	0.056	74	159
beta-Endosulfan	0.22	0.056	74	159
Endosulfan sulfate			74	159
Endrin	0.18	0.0023	0.2	
Endrin aldehyde			0.2	
Heptachlor(4)	0.52	0.0038	0.00028	0.00029
Heptachlor epoxide(4)	0.52	0.0038	0.00028	0.00029
alpha-BHC(4) (Hexachlorocyclohexane-alpha)			0.0092	0.031
beta-BHC(4) (Hexachlorocyclohexane-beta)			0.016	0.055
gamma-BHC (Lindane) (4) (Hexachlorocyclohexane-gamma)	2	0.08	0.019	0.063
PCB 1242 (Arochlor 1242)(4)	0.014	0.000079	0.000079	
PCB-1254 (Arochlor 1254)(4)	0.014	0.000079	0.000079	
PCB-1221 (Arochlor 1221)(4)	0.014	0.000079	0.000079	
PCB-1232 (Arochlor 1232)(4)	0.014	0.000079	0.000079	
PCB-1248 (Arochlor 1248)(4)	0.014	0.000079	0.000079	
PCB-1250 (Arochlor 1260)(4)	0.014	0.000079	0.000079	
PCB-1016 (Arochlor 1016)(4)	0.014	0.000079	0.000079	
Toxaphene(4)	0.73	0.0002	0.00071	0.00073
Antimony			146	45,000
Arsenic(4)	360	190	0.002	0.017
Asbestos(4)			30,000 fibers/1	
Beryllium(4)			0.0037	0.064
Cadmium	3.9(6)	1.1(6)	10	
Chromium (III)	1700(6)	210(6)	50	3,433,000
Chromium (VI)	16	11	50	
Copper	18(6)	12(6)		
Cyanide (total)	22	5.2	200	
Lead	82(6)	3.2(6)	50	
Mercury	2.4	0.012	0.144	0.146
Nickel	1400(6)	160(6)	13.4	100
Selenium	20	5	10	
Silver	4.1(6)		50	
Thallium			13	48
Zinc	120(6)	110(6)		
Dioxin (2,3,7,8-TCDD)(4)			0.000000013	0.000000014

Table 8. Concluded.

(1) The values given in this table refer to the total or total recoverable (dissolved plus suspended) amount of each substance as $\mu g/L$.

(2) Based on two routes of exposure - ingestion of contaminated aquatic organisms and drinking water.

(3) Based on one route of exposure - ingestion of contaminated aquatic organisms only.

(4) Substance classified as a carcinogen with the value based on an incremental risk of one additional instance of cancer in one million persons.

(5) Chemicals which are not individually classified as carcinogens but which are contained within a class of chemicals with carcinogenicity as the basis for the criteria derivation for that class of chemicals; an individual carcinogenicity assessment for these chemicals is pending.

(6) Hardness dependent criteria. Value given is an example only and is based on a $CaCO_3$ hardness of 100 mg/L.

(7) pH dependent criteria. Value given is an example only and is based on a pH of 7.8.

(8) The applicability for the I Classification will be determined on a case-by-case basis based on site-specific ambient water quality.

A few fish kills have been caused by pollution in Montana since 1990 (Table 9). No known point source discharges were responsible for the fish kills. Localized thunderstorms and nonpoint source runoff were associated with most of the fish kills.

Catch-and-release fishing regulations have been implemented for Silver Creek (tributary of Hauser Lake) because of mercury contamination from past mining activities. These were continued during the reporting period.

Table 9. Waterbodies which had fish kills during the 1990-92 reporting period.

Waterbody Id Number	Waterbody Name	Source and Cause of Pollutant
		1990
MT76G004	Mill-Willow Creek	high metals from thunderstorm runoff
MT41I006	Ten Mile Creek	chemical surfactant runoff
		1991
MT76D002	Lake Creek	short duration total suspended solids
MT40P001	Wold Reservoir	unknown
MT43Q002	Arrow Creek	feedlot runoff from thunderstorm
MT76G004	Little Blackfoot River	unknown
MT76G001	Clark Fork River	metals from thunderstorm runoff

4.5 Surface Water Supplies and Public Health.

During the past two-year period, public water supplies using surface water have faced a variety of challenges relating to water quality. Among these challenges were implementation of the Surface Water Treatment Rule of the 1986 Amendments to the Federal Safe Drinking Water Act, high river flows and associated high turbidity caused by an unusually wet spring in 1991, and algae blooms in late Summer 1990.

Implementation of the Surface Water Treatment Rule had special implications for public water suppliers seeking to avoid filtration of their surface water sources. Federal and State criteria for avoiding filtration include strict watershed control programs and minimum raw water quality standards for turbidity and coliform bacteria concentrations. There are currently four surface water supplies in Montana that now meet these criteria and a fifth is actively gathering data to demonstrate compliance (Table 10). Impacts of logging, stream recreational use, nonpoint source contamination, grazing practices and other watershed activities have a major impact on a source's potential to meet the rigid standards. Development of filtration avoidance criteria and review of the subsequent applications forced the Water Quality Bureau to take a closer look at traditional watershed management programs. It also resulted in more coordinated efforts to review existing water use classifications and to incorporate the needs of public water suppliers directly into existing watershed management policies and programs.

Table 10. Montana public water supplies and municipalities served which meet raw surface water quality standards for turbidity and coliform bacteria concentrations.

Water Supply	Municipality Served
Basin Creek Reservoir	Butte
Fred Burr Lake	Philipsburg
Hellroaring Creek	Polson
Indian Creek	Ronan
Ashley Creek	Thompson Falls (under study)

Precipitation events in 1991 resulted in turbidity violations for several unfiltered surface water supplies. Concurrent and subsequent bacteriological contamination problems were detected in some distribution systems. The affected public water supply systems, most notably in Butte and Anaconda were required to enact boil orders to warn consumers of threats to public health. High water levels were also associated with increased bacteriological contamination levels in shallow ground water wells used as sources of public water supplies. It is important to note, however, that the higher incidence of fecal and total coliforms in water sources coincided with more strict monitoring requirements for

public water suppliers required by the 1986 Amendments to the federal Safe Drinking Water Act. This monitoring likely elevated the number of source problems detected due to the improved sampling and analysis requirements.

Algae blooms in Colstrip's raw water reservoir and some of Butte's finished water reservoirs created taste and odor concerns in 1990. These blooms also prompted a Bureau investigation of algal toxicity in the case of Colstrip.

In addition to these unusual impacts, Montana continues to face concerns over Giardia and now Cryptosporidium contamination of surface water sources. These parasites are known to occur in Montana and are assumed to be distributed state-wide. Public water suppliers using surface water are facing more strict finished water quality standards as a result of the recognized health threat of these organisms.

5.0 WETLANDS.

The Montana Department of Health & Environmental Sciences, Water Quality Bureau has received a US EPA grant for more than $433,000 to fund a statewide, interagency wetlands program that will include six components. The Bureau will administer the program and will take the lead in the first two components described below. The remaining components will be undertaken by other state agencies under contract with DHES. The individual program components are:

Component 1. The Water Quality Bureau will fill a half-time position to lead the collection of wetland information and data from all state and federal natural resource agencies, assist in the development of a wetlands database, develop and execute a Memorandum of Understanding between the agencies and conservation/user groups, establish a Wetlands Conservation Council consisting of an administrative and technical representative of each organization, and develop and initiate a state wetlands protection and conservation strategy that will coordinate the activities of all those with interests in wetlands.

Component 2. The Water Quality Bureau will monitor 20 water quality impaired wetlands and 40 least-impaired wetlands to establish baseline water quality and biological conditions. The data will be used to develop specific water quality and biological standards for Montana wetlands.

Component 3. The Department of Natural Resources and Conservation (DNRC) will develop wetland education programs for adults (videos, brochures, fact sheets, etc.) and for grade school children. The Montana Watercourse at Montana State University will incorporate a wetland component into their statewide water resource education program.

Component 4. DNRC will fill a half-time position to implement river corridor management projects on selected rivers in Montana. The position will work with conservation districts to resolve localized river management problems (e.g., water rights disputes). The position will be combined with an existing Rangeland Resource position at DNRC.

Component 5. The Department of Transportation (DOT) will perform audits of their existing wetland protection/mitigation program, hire a contractor to critique the program and existing and proposed mitigation projects, develop an advanced tracking and accounting system for wetland losses/mitigation and banking, and will develop and implement a monitoring program for existing mitigation sites to judge their effectiveness.

Component 6. The Montana Riparian Association (MRA) will develop a wetland training program, perform statewide tests of wetland jurisdictional delineation, implement the Geographical Information System (GIS) mapping of the upper Missouri River reach designated as a Wild & Scenic River, and print a statewide classification and management document for riparian and wetland sites in Montana.

The Department of Fish, Wildlife & Parks and the US Fish & Wildlife Service are also actively pursuing wetland protection, conservation and acquisition programs not included in the above description. The wetlands strategy will attempt to coordinate the activities of the various agencies and organizations to avoid duplication of effort and the unnecessary expenditure of scare financial resources. The strategy <u>will not</u> attempt to redirect or reduce the statutory authority or responsibility of any agency for wetland protection and conservation.

The 1992 assessment of Montana's wetlands has not changed from the 1990 reporting cycle. The size of the wetlands may have undergone changes due to persistent drought conditions in much of Montana. Elevated concentrations of salts, selenium and other trace elements and pesticides from agricultural and irrigation practices are some of the water quality concerns. The interagency program described above will answer some basic questions about wetlands and strengthen efforts to protect them.

6.0 LAKES.

Lakes discussed in this report are considered "significant publicly-owned lakes/reservoirs/ponds." These are lakes listed in the Department of Fish, Wildlife and Parks (DFWP) lakes database, lakes that contain a publicly accessible game-fish population, or lakes that are a valuable recreational and aesthetic resource. A minimum size has not been assigned. The Reach File 3 (RF3) database of waterbody size and numbers used in this report is a superset database to the DFWP and Reach File 2 databases. The number and acres of privately-owned or man-made reservoirs, ponds and wetland potholes in RF3 are unknown.

6.1 Use Support.

More than two thirds of Montana's lake acres support the overall use category (Table 11). More than half (57%) were assessed using monitored data. The size of lakes monitored (Table 12) increased during the reporting period by 54,036 ac. Similar to the streams of Montana, the majority of lake acres were impaired by nonpoint sources and causes (Tables 13 and 14).

The lake acres assessed threatened but fully supporting and the non-supporting category remained the same as that reported in 1990. The partially supporting category increased by 6,480 acres.

6.2 Trophic Status.

The size and number of lakes in each trophic class (i.e., state of nutrient enrichment and productivity) are given in Table 15. The trophic status of the lakes was evaluated by fisheries biologists in the field. Specific numeric standards or indices for lake trophic status have not been adopted at this time.

Table 11. Level of support for individual uses of Montana lakes (acres).

Use	Supporting	Supporting but Threatened	Partially Supporting	Not Supporting	Not Attainable	Not Assessed
Overall Use Support	656,042	37,627	271,113	14,651	0	0
Aquatic Life Support	325,920	0	621,353	26,505	0	0
Cold Water Fishery-Trout	61,336	137,627	148,783	4,153	0	0
Warm Water Fishery	0	0	257,593	9,100	0	0
Recreation	140,080	129,382	332,619	11,151	0	0
Swimming	486,238	0	465,238	22,302	0	0
Drinking Water Supply	291,650	0	314,041	12,900	0	0
Agriculture	600,297	0	5,394	12,900	0	0
Industrial Use	618,591	0	0	0	0	0

Table 12. Overall level of use support of lakes using evaluated and monitored assessment methods.

Number of Evaluated Lakes: 10,485
Number of Monitored Lakes: 14

Degree of Use Support	Acres Evaluated	Acres Monitored	Total Acres
Fully Supporting	312,593	58,968	371,561
Threatened	8,270	129,357	137,626
Partially Supporting	98,352	357,242	455,594
Not Supporting	5,251	9,400	14,651
Not Attainable	0	0	0
Total	424,466	554,967	979,433

Table 13. Sources of impairment for Montana lakes (acres).

Source Categories	Impact Major	Moderate/Minor	Total
POINT SOURCES:			
Municipal Point Sources	0	5,100	5,100
NONPOINT SOURCES:			
Agriculture (General)	0	56,544	56,544
Nonirrigated Crop Production	3,800	15,132	18,932
Irrigated Crop Production	12,900	302,233	315,133
Pasture Land	1,399	0	1,399
Range Land	0	289,475	289,475
Silviculture (General)	0	38,972	38,972
Construction (General)	0	0	0
Highway/Road/Bridge	0	4,120	4,120
Land Development	0	10,901	10,901
Urban Runoff/Storm Sewers (General)	0	0	0
Surface Runoff	0	546	546
Resource Extraction (General)	0	0	0
Subsurface Mining	0	1,600	1,600
Placer Mining	0	1,600	1,600
Land Disposal (General)	0	0	0
Onsite Wastewater Systems (Septic Tanks)	0	9,708	9,708
Hydromodification (General)	0	0	0
Dam Construction	0	59,649	59,649
Flow Regulation/Modification	0	299,629	299,629
OTHER:			
In-place Contaminants	0	2,066	2,066
Natural	22,049	322,945	344,994

Table 14. Causes of impairment in Montana lakes (acres).

Cause Categories	Impact Major	Moderate/Minor	Total
Unknown	0	5,028	5,028
Metals	16,449	302,175	318,624
Nutrients	0	319,316	319,316
pH	5,600	0	5,600
Siltation	0	81,822	81,822
Organic Enrichment/Dissolved Oxygen	0	259,702	259,702
Salinity/Total Dissolved Solids/Chlorides	12,900	12,595	25,495
Thermal Modifications	0	33,944	33,944
Flow Alteration	0	363,221	363,221
Other Habitat Alterations	0	6,848	6,848
Pathogens	1,399	13,312	14,711
Suspended Solids	0	310,844	310,844
Noxious Aquatic Plants	0	306,019	306,019
Filling and Draining	353	0	353

Table 15. Trophic status of Montana lakes. Source: Montana Department of Fish, Wildlife and Parks Lakes File, April 18, 1986.

Trophic Status	Number of Lakes	Acres
Oligotrophic (1)	452	254,692
Mesotrophic (2)	428	348,522
Eutrophic (3)	371	39,262
Dystrophic (4)	127	670
Unknown (5)	502	20,217

(1) Oligotrophic Lake: Nutrient poor, oxygen rich, depth usually greater than 25 feet, bottom material mostly inorganic, dissolved oxygen plentiful at bottom, emergent aquatic plants absent, total dissolved solids less than 30 ppm, plankton scarce.

(2) Mesotrophic Lake: Attributes intermediate between those for oligotrophic and eutrophic lakes, depth usually greater than 20 feet.

(3) Eutrophic Lake: Usually 10 to 25 feet deep, bottom material mostly organic, dissolved oxygen often absent at bottom, emergent aquatic plants present, total dissolved solids more than 30 ppm, plankton abundant.

(4) Dystrophic Lake: Includes bog lakes, depth less than 20 feet, characterized by incomplete decay of plants, accumulation of humic materials, bottom material entirely organic, water saturated with dissolved oxygen during daylight hours, below saturation at night, emergent aquatic plants and plankton abundant.

(5) Unknown Lakes: Lakes in the data file with surface area available that have not been assessed as to trophic status. Two additional lakes have trophic status but not acreage: one is oligotrophic and one is mesotrophic.

6.3 Control Methods.

Lake pollution control has been multi-faceted. For example, in the Flathead Lake watershed:

1) Sewers have been installed or are in planning/design stages for the near-shore residential areas;

2) Phosphorus detergent bans have been installed;

3) Advanced treatment methods at municipal wastewater treatment plants are being used;

4) Monitoring of lake and tributary quality is in progress;

5) Nonpoint source demonstration projects are being implemented; and

6) Educational and public awareness programs have been implemented.

6.4 Restoration Efforts.

Lake restoration projects during the 1990-92 reporting cycle have concentrated on the Flathead Lake basin. Long term monitoring has continued and water pollution of control and management projects have been implemented for Flathead Lake. Section 314 Phase I diagnostic and feasibility studies are being implemented on Flathead Lake and Swan Lake. The Flathead Lake study will gather information on the nutrient status of the lake and its primary productivity. Information on the release of nutrients from the sediments of Ashley Creek will also be collected. The Swan Lake study will determine nutrient loading and primary productivity as well as estimate the mass transfer of water, sediments and nutrients into and from the lake.

The information collected from these studies will identify the sources and magnitude of pollution to the lakes and help determine the technical feasibility of control and restoration methods.

6.5 Acid Deposition.

Research on the susceptibility of Montana's alpine and inter-mountain lakes to acidification has been performed by several organizations. Information gathered by the US Forest Service, DFWP, and Montana's University researchers indicate that many lakes are sensitive to acid precipitation and atmospheric fallout. Most of the sensitive lakes are located on National Forest lands. Continued monitoring will be required to detect any changes in lake acidity. The number of lakes impacted by increased acidity is not known at this time.

6.6 Toxics.

The lake acreage monitored for toxics was 615,935 acres, of which elevated levels of toxics were found in 270,847 acres (Table 7). These acreages comprise 63% and 28%, respectively, of the total lake size of Montana. Naturally and unnaturally impaired lakes have not been differentiated, nor have reservoirs (e.g., Fort Peck) been separated from natural lakes.

DHES and DFWP are implementing a Clean Lakes Program (§314) water quality assessment of lake trophic status and methylmercury and polychlorinated biphenyls

(PCBs) in fish tissues and sediments. Twenty of the most heavily fished lakes in Montana totaling 515,000 acres have been targeted. These targeted waterbodies represent more than half of the total lake acreage in Montana.

6.7 Water Quality Trends.

Long-term monitoring data required for trend analysis of Montana's lakes has been lacking except for Flathead Lake. Flathead Lake data have shown a decline in lake quality due to increased algal production since 1977. Studies are in progress to diagnose sources of nutrient enrichment and determine the feasibility of corrective actions. Monitoring of Flathead Lake will continue through the next (1992-94) reporting cycle, funds permitting. The studies outlined above and now being implemented under the Clean Lakes Program (§314) of the Clean Water Act will provide information which will form the basis for lake quality trend analysis at a later time.

7.0 IMPAIRED WATERBODIES.

A list of the impaired waterbodies in Montana has been generated and is available on request from the Water Quality Bureau. Detailed information on individual threatened or impaired waterbodies is also available from the Bureau.

8.0 GROUND WATER QUALITY.

8.1 Ground Water Resources.

About 54% of Montana's population uses ground water for domestic purposes; 98% of the rural population depend on ground water. Of the 2,264 public water supplies, all but 98 rely on ground water. Ground water provides drinking water for 620 communities, 24 water districts, 146 schools, and 1,176 restaurants, campgrounds, motels, ski slopes, etc. Over 75% of these public water supplies obtain their ground water from Quaternary alluvial aquifers. Of the total amount of ground water used in Montana, 54 Mgal/day (27%) is for public water supplies, 14 Mgal/day (7%) is for rural domestic use, 94 Mgal/day (48%) is for irrigation, 9 Mgal/day (4%) is for stockwater use, and 29 Mgal/day (14%) is for industrial use.

For the most part, ground water in Montana has not been degraded by human-caused contamination. However, natural substances lower the water quality of many of the consolidated aquifers. Concentrations of dissolved solids commonly exceed the national secondary drinking water standard of 500 milligrams per liter (mg/l) especially in the eastern aquifers. Dissolved solids can range from 400 to 5,000 mg/l in eastern Montana and 100 to 200 mg/l in western Montana.

8.2 Ground Water Management Strategy.

In March, 1992, the Ground Water Quantity/Quality Steering Committee of the State Water Plan Advisory Council of the legislature surveyed the ground water quality issues. They identified five major issues:

Issue 1 - Coordinate Quantity and Quality Permitting. Waste discharge permits and water use permits are granted independently by the Department of Health and Environmental Sciences (DHES) and the Department of Natural Resources and Conservation (DNRC), respectively, without considering the interrelationships of ground water quality and quantity. Options were recommended to allow DNRC to consider water quality, develop a process to notify discharge permit holders, establish a process to consider quantity

in quality permits, allow state and local agencies to petition for controlled ground water areas, amend controlled ground water area statutes to allow showing of contaminant migration or degradation, and develop pollution source tracking system.

Issue 2 - Long-term Planning. Montana lacks a comprehensive, long-term ground water quality/quantity management plan. Options were recommended to establish a state coordination committee, develop a state comprehensive ground water program, assist conservation districts with local water management planning, and support funding for the ground water assessment program.

Issue 3 - Well Construction Enforcement. Well construction standards are not adequately enforced. Options were recommended to develop a driller notification program to allow inspectors to perform random evaluations.

Issue 4 - Unplugged Holes. Mineral exploration, geotechnical, and seismic holes presently are not completely plugged to assure ground water contamination will not occur. Options were recommended to develop a hole-plugging program and inventory, develop consistent hole-plugging requirements, and allocate Resource Indemnity Trust funds to plug holes.

Issue 5 - Protection from Mining Impacts. Mining activities can adversely affect both ground water quality and quantity. Options were recommended to amend rules to reflect guidelines for hydrologic studies and encourage mining companies to obtain early public input.

Issue 6 - Information/Education. Presently, ground water information is not readily available to the public. Options were recommended to request WET (Water Education for Teachers) to include water quality/quantity information, distribute DNRC well brochures, develop public service announcements, and provide a toll-free number to answer or direct water questions.

8.3 Wellhead Protection Strategy.

The draft Montana Wellhead Protection Program Plan is undergoing public review and will be submitted to the EPA for approval in July, 1992. The goal is to prevent contamination of the ground water that supplies public water supply wells. Most of these wells that are vulnerable to contamination are found in the alluvial valleys of the state.

8.4 Major Sources of Contamination.

8.4.1 Injection Wells.

Class V injection wells and storm water drains are a major source of organic contaminants. These wells are concentrated in urban areas. The Montana EPA office estimates that Montana has about 10,000 dry wells for storm drainage, 400 industrial injection wells, and 500 automotive injection wells. About 150 of the automotive injection wells have been closed.

8.4.2 On Site Sewage Disposal and Septic Systems.

Approximately 120,000 individual, on-site septic systems are used by 300,000 people in Montana. Officials have not adequately documented the impacts of these systems on ground water quality but septic system failures are suspected to cause substantial, widespread coliform and nutrient contamination to ground water.

In 1989, the Montana State University Extension Service initiated a private well test program by offering low cost water analysis to well owners who were concerned about their water quality. Nearly 1300 private well samples were analyzed. Coliform contamination was found in 40% of the water samples. The contaminated samples were evenly distributed throughout the state.

Where septic system failures are documented, the Legislature has authorized the Department of Health and Environmental Studies to issue cleanup orders to local governments. Other legislation requires Local Boards of Health to regulate septic and sewer systems.

8.4.3 Underground Storage Tanks.

As of May 1992, Montana had registered 22,482 underground storage tanks. The majority of tanks were installed 10 to 20 years ago. · Most tanks were on residential, commercial, or farm property. All new underground tanks must be fitted with leak detection systems.

There have been 963 confirmed releases from underground tanks and new reports come in at a rate of 20 to 30 per month. Fewer than half of the releases have reached ground water. There are five known incidents of benzene contamination to public water supplies. The Water Quality Bureau is in the process of issuing ground water permits to five land farm sites to handle treatment and disposal of contaminated soils from leaking petroleum tanks.

8.4.4 Superfund Sites.

Montana has eight sites listed on the federal Superfund National Priority List. As of October 1991, there were 236 sites prioritized for remedial action through the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Unlike the federal Superfund Act, this act also addresses sites that have asbestos or petroleum contamination. Fifty-nine of these sites have documented impacts to ground water.

8.4.5 Hazardous Waste Sites.

Montana currently has approximately 416 registered generators and recyclers of hazardous wastes. About 40 hazardous waste transporters are registered with the Solid and Hazardous Waste Bureau. Many smaller businesses handle hazardous materials but are not required to register. There are currently 11 permitted facilities that treat, store, or dispose of hazardous waste.

8.4.6 Spills and Unanticipated Releases.

An average of 300 incidents are reported each year to the Hazardous Materials Emergency Response System. Of these incidents, about 5% will require extensive cleanup and monitoring. In the past year, a tanker truck rolled off the highway and spilled about 1,000 gallons of gasoline within 500 feet of a community water supply well. Through prompt action, the effects of the spill where minimized and the well was protected from petroleum contamination.

8.4.7 Agrichemicals and Agricultural Practices.

Seven pesticides have been detected in Montana ground water. These include the herbicides atrazine, 2,4-D, dicamba, MCPA, picloram, simazine and the insecticide aldicarb. All the detection levels were below established health guidance levels. The Montana Agricultural Chemical Ground Water Protection Act directs the Department of Agriculture and the Department of Health and Environmental Sciences to develop specific management plans implementing best management practices (BMPs) for such sites.

The Nonpoint Source Pollution Control Program estimates that 46% of surface water nonpoint pollution is generated by agriculture. The program is developing BMPs to address the full range of farming and ranching operations. A major area of concern affecting ground water is salinity control. The program is also funding a basin-wide ground water study of the Clarks Fork of the Yellowstone River.

8.4.8 Mineral Processing and Oil and Gas Exploration.

The Department of State Lands has reported that between two-thirds and three-fourths of the mines that have used cyanide to process ore in Montana have had documented fluid losses. There are about 30 ore processors that use cyanide, 14 of which are inactive at this time. Of the releases, four were of a magnitude to affect ground water quality beyond the boundaries of the mine property. Two resulted in the contamination of nearby domestic wells. While the threat to ground water from this source is less significant than other contaminant sources, it has been the subject of much public debate as mining companies have petitioned the Board of Health for waivers to its nondegradation requirement.

The American Petroleum Institute estimated that for the 623 wells drilled in 1985, 4.5 million barrels of drilling fluids were produced. An average of 7,330 barrels per well. This fluid can contain benzene, phenanthrene, barium, fluoride, antimony, along with high concentrations of calcium, magnesium, sodium, chloride, and sulfate. The salts can easily migrate with soil water into the

ground water. There are documented cases where these wastes have contaminated domestic water supplies and surface soils in eastern Montana. Contaminated ground water has also been detected entering streams and drainage ditches. The extent of the problem is unknown.

8.4.9 Landfills.

Municipal solid waste landfills are a significant source of ground water contamination in Montana. Twenty-five years ago there were about 500 in the state. In 1987, there were 140 landfills operating and only a dozen had begun ground water monitoring. In response to Subtitle D of the 1976 Resource Conservation and Recovery Act, the EPA has proposed regulations requiring ground water monitoring on an ongoing basis for thirty years after closure of a landfill. In 1989, the Legislature required site plan review for new landfills and expanded ground water monitoring.

Many small landfills are closing. After Subtitle D regulations are adopted, the Department of Health and Environmental Sciences estimates there will be only 35 to 75 regional landfills operating in the state.

Table 16 summarizes and ranks the major sources of ground water contamination. Table 17 summarizes and ranks the substances contaminating ground water.

8.4.10 Ground water Indicators.

Two studies have looked at levels of nitrates and pesticide residues in Montana well water. The nitrate study concluded that nitrate concentration in ground water is more related to geologic, soil, and climatic conditions and cropping practices rather than fertilizer use. The pesticide residue study indicates that the relatively fast ground water movement found in most shallow aquifers in Montana restricts the ability to detect measurable quantities of these substances unless the sampling schedule closely follows application schedules. Given these conclusions, these two indicators would not adequately describe ground water trends.

Montana is currently compiling data on CECRA sites and saline seep areas. Data is also compiled on Maximum Contaminated Level (MCL) violations in public water supplies that use ground water. The contaminants of most interest are nitrates and volatile organic compounds. However, no trend analysis has been undertaken to determine if these variables would serve as indicators to evaluate ground water quality in Montana. In order to undertake such a trend analysis, additional funds are needed for contracted services or additional staff time.

Table 16. Sources of ground water contamination in Montana.

Source	Relative Priority of Major Sources
Septic Tanks	2
Municipal landfills	9
On-site industrial landfills (excluding pits, lagoons, surface impoundments)	
Other Landfills	
Surface impoundments (excluding oil and gas brine pits)	
Oil and gas brine pits	8
Underground storage tanks	3
Injection wells (incl. Class V)	1
Abandoned hazardous waste sites	4
Regulated hazardous waste sites	
Land application/treatment	
Agricultural activities	6
Road salting	
Mineral Processing	7
Spills and Unanticipated Releases	5

Table 17. Substances contaminating ground water in Montana.

Organic chemicals:		Metals	X
Volatile	X		
Synthetic		Radioactive material	
Inorganic chemicals:		Pesticides	X
Nitrates	X		
Fluorides		Other agricultural chemicals	
Arsenic	X		
Brine/salinity	X	Petroleum products	X
Cyanide	X		
Other		Others (specify)	

X = Substances of major importance

9.0 SPECIAL STATE CONCERNS AND RECOMMENDATIONS.

Montana has been fortunate in having a large number of pristine streams, lakes, and aquifers and a low population with little heavy industry. However, as global population rises and demands upon the State's natural resources increase, maintaining the quality of Montana's waterbodies and aquifers will become more difficult. The major goals of Montana's water quality programs are to maintain the quality of Montana's lakes, streams, wetlands and ground waters and at the same time return impaired waterbodies and aquifers to their natural condition.

Specific areas of concern are the effects of mineral extraction on pristine mountain streams and aquifers, logging of steep slopes and in riparian areas, coal strip-mining in semi-arid eastern Montana, impacts of present agricultural activities including saline seep, stream dewatering and sedimentation, increased residential development in riparian areas along streams and lakes, waste disposal, chemical spills and the increased consumptive and recreational demands upon a finite aquatic resource.

To meet these challenges, Montana's water quality protection programs will need to grow and become more sophisticated. This will require additional funding and a pay scale that attracts and retains highly qualified professionals. The most promising source of revenue is a system of fees assessed on dischargers of treated wastewater. The Department recommends including such a fee system in the reauthorization of the federal Clean Water Act and in draft legislation to be presented to the 1993 session of the Montana Legislature.

Since nonpoint sources account for over 90% of the impaired surface waters in Montana, emphasis should be given to restoring impaired waters and protecting high quality waters threatened by agriculture, mining, and forest practices. The Department will continue to monitor the effectiveness of its largely voluntary nonpoint source control program. If this approach proves to be ineffective, the Department may need to emphasize a more regulatory approach, particularly in the areas of agriculture and forest practices. The existing legal framework would allow the Department to make this transition.

To adequately measure the effectiveness of the state's nonpoint source control program and other water pollution control programs would require a greatly expanded monitoring and assessment effort. Fixed-station monitoring in Montana is limited to three of the state's 16 river basins: the Flathead and upper and lower Clark Fork. The Department currently has resources to conduct about 80 waterbody field assessments each year. This is for a water resource that includes over 10,000 lakes, 178,000 miles of streams, and 2 million acres of wetlands. The Department will ask the Legislature to fund additional staff and operating expenses to expand ambient monitoring in the state and to initiate a Lakes Management and Volunteer Monitoring Project.

Securing long-term funding is critical for the success of both the monitoring and nonpoint source control programs. Congress should appropriate the full amount authorized for nonpoint source control programs in 1987. A special appropriation should be considered for conducting nonpoint source assessments, which would greatly facilitate project planning and setting restoration priorities for impaired waterbodies. A new and separate set-aside should be established to replace the 604(b) set-aside for water quality management planning, which is scheduled to end in federal fiscal year 1994. Funding of that program should be increased above the existing level.

The US EPA could best help Montana manage its water quality concerns through long term financial support and clear consistent guidance. The only way to address the concerns described will be through active statewide water quality monitoring and the application of best management practices and state-of-the-art technology to all causes and sources of water impairment.